

WHAT IS CLAIMED IS:

1. A method for printing on a wafer, comprising:
  - (a) producing an exposure beam with polarized illumination light, wherein the illumination light is polarized according to a predetermined polarization pattern;
  - (b) illuminating a mask to produce an image in the exposure beam; and
  - (c) exposing a photoresist layer on the wafer with light in the exposure beam.
2. The method of claim 1, wherein said step (a) further comprises producing polarized illumination light according to a radial polarization pattern.
3. The method of claim 1, wherein said step (a) further comprises producing polarized illumination light according to a tangential polarization pattern.
4. The method of claim 1, wherein said step (a) further comprises producing polarized illumination light according to a custom polarization pattern.

5. The method of claim 1, wherein said step (a) further comprises producing polarized quadrupole illumination.
6. The method of claim 1, further comprising before said step (a):  
  
emitting pre-polarized light to produce illumination light.
7. The method of claim 1, wherein said step (b) comprises illuminating a mask to produce an image that includes contact holes.
8. The method of claim 1, wherein said step (c) occurs in a liquid.
9. The method of claim 1, wherein the mask is at least one of the group consisting of: chromeless phase-shift mask, attenuating phase-shift mask, and alternating phase-shift mask.
10. The method of claim 1, wherein the mask is a binary mask.
11. A method of printing on a wafer, comprising:  
  
(a) producing an exposure beam with polarized illumination light, wherein the illumination light is

polarized according to a predetermined polarization pattern;

- (b) illuminating a chromeless phase-shift mask to produce an image in the exposure beam; and
- (c) exposing a negative photoresist layer on the wafer with light in the exposure beam.

12. A method of printing on a wafer, comprising:

- (a) producing an exposure beam with polarized illumination light, wherein the illumination light is polarized according to a predetermined polarization pattern;
- (b) illuminating an attenuating phase-shift mask to produce an image in the exposure beam; and
- (c) exposing a positive photoresist layer on the wafer with light in the exposure beam.

13. A method of printing on a wafer, comprising:

- (a) producing an exposure beam with polarized illumination light, wherein the illumination light is polarized according to a predetermined polarization pattern;
- (b) illuminating a binary mask to produce an image in the exposure beam; and

- (c) exposing a positive photoresist layer on the wafer with light in the exposure beam.
14. A method of printing on a wafer, comprising:
- (a) illuminating a phase-shift mask with pre-polarized light;
  - (b) shaping said pre-polarized light to produce an exposure beam, wherein the pre-polarized light is shaped according to a predetermined polarization pattern and intensity pattern; and
  - (c) exposing a photoresist layer on the wafer with the exposure beam.
15. A lithography system, comprising:
- (a) an illumination source that emits illumination light along an optical path;
  - (b) a pattern polarizing device that converts illumination light from the illumination source into an exposure beam with a predetermined polarization pattern;
  - (c) a mask that produces an image in the exposure beam;
  - (d) a projection optic that relays the exposure beam for printing on a wafer.

16. The lithography system of claim 15, wherein said illumination light is pre-polarized illumination light, and wherein said pattern polarizing device is a wave plate.
17. The lithography system of claim 15, wherein said illumination light is pre-polarized illumination light, and wherein said pattern polarizing device is a polarizer.
18. The lithography system of claim 15, wherein said illumination light is unpolarized illumination light, and wherein said pattern polarizing device is a polarizer.
19. The system of claim 15, further comprising:
  - (e) a wafer exposed by the exposure beam.
20. The lithography system of claim 19, further comprising a liquid filling a space between said projection optic and said wafer.
21. The lithography system of claim 15, wherein said pattern polarizing device is included in the projection optic.

22. The lithography system of claim 15, wherein said predetermined polarization pattern is a radial polarization pattern.
23. The lithography system of claim 15, wherein said predetermined polarization pattern is a tangential polarization pattern.
24. The lithography system of claim 15, wherein said predetermined polarization pattern is a custom polarization pattern.
25. The lithography system of claim 15, wherein said mask is one of the group consisting of: a chromeless phase-shift mask, an attenuating phase-shift mask, a binary mask, and an alternating phase-shift mask.
26. The lithography system of claim 15, wherein said image includes contact holes for a wafer.
27. A method of producing contact holes on a wafer, comprising:
  - (a) producing a polarized illumination beam;
  - (b) illuminating a mask with the polarized illumination beam to create an exposure beam, wherein said mask

produces a contact hole image in the exposure beam;  
and

(c) exposing a wafer with the exposure beam.

28. The method of claim 27, wherein said step (b) further comprises illuminating a phase-shift mask.

29. The method of claim 27, wherein said step (a) further comprises producing a radially polarized illumination beam.

30. The method of claim 27, wherein said step (a) further comprises producing a tangentially polarized illumination beam.

31. The method of claim 27, wherein said step (a) further comprises producing a custom polarized illumination beam.